New York Space Grant Consortium
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Consortium URL: http://astro.cornell.edu/spacegrant/
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The New York Space Grant Consortium is a Designated Consortium funded at a level of $575,000 for fiscal year 2013.

PROGRAM GOALS

The New York Space Grant (NYSG) Consortium aims to inspire, engage, and educate students in science, technology, engineering, and math (STEM) disciplines, and to prepare students across NY State to be the future workforce for NASA and other high-technology industries. The specific SMART objectives tied to the following NYSG consortium goals are listed at the end of the Program Accomplishments section:

NYSG Goal #1: Our NASA Education Outcome 1 programs (Fellowship/Scholarship, Higher Education, and Research Infrastructure) will positively impact the **diversity** of students entering the STEM workforce and pursuing advanced STEM degrees.

NYSG Goal #2: Our NASA Education Outcome 1 programs (Fellowship/Scholarship, Higher Education, and Research Infrastructure) will positively impact the **number** of students entering the STEM workforce and pursuing advanced STEM degrees.

NYSG Goal #3: Our consortium will help build NY State higher education-industry collaborations, while assisting with high technology workforce development to decrease the "brain drain" afflicting NY State.

NYSG Goal #4: Our NASA Education Outcome 2 (Precollege Education) programs will attract and retain students in STEM disciplines though K-12 teacher professional development and K-12 student opportunities.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1,2, & 3)

Examples of NYSG benefits to Outcome 1 (Fellowship/Scholarship, Research Infrastructure, and Higher Education):

Years of hard work by students and faculty at Medgar Evers College (MEC), City University of New York (CUNY) finally paid off as they watched their inaugural CubeSat, CUNYSAT-1, launch into space on an Atlas 5 rocket on December 5, 2013. Eleven student team members plus three faculty advisors attended the launch at Vandenberg Air Force Base, California. This hands-on, interdisciplinary science and engineering project benefited from multiple levels of Space Grant and other NASA support, including funds won from the Space Grant Minority Serving Institution Partnership Development Competition (initial MEC-Cornell collaboration during fiscal year 2009), continuous annual funding from NYSG, and NASA's Educational Launch of Nanosatellites (ELaNa) program. Planning has already begun on CUNYSAT-2.

Supported by NYSG, a Syracuse University undergraduate minority (Hispanic) student conducted environmental science research on the effectiveness of a nearby constructed wetland in treating agricultural wastewater. He later traveled to Harvard University to present a poster titled "Seasonal Variance in the Madison County Constructed Wetland" at the National Collegiate Research Conference (January 23-25, 2014). He reported: "Out of 170 participants I was able to win 3rd place. It was one of my greatest experiences. Not only was I able to meet the top undergraduate researchers from all over the nation, but I was also able to network and make new connections."

Example of NYSG benefits to Outcome 2 (Precollege):

With continued support from NYSG, Syracuse University and the Museum of Science and Technology (MOST) ran several hands-on STEM competitions for 4th through 12th grade students in the central New York (CNY) region. The fourteenth annual fall CNY Bridge Build'em and Bust'em involved 798 students, the eleventh annual spring CNY Rocket Team Challenge involved 545 students, and the third CNY Regional VEX Robotics competition involved 200 students. Meanwhile, in western New York, SUNY Buffalo ran the five-week Buffalo Engineering Awareness for Minorities (BEAM) program, partially funded by NYSG. Seventeen post-11th grade minority students benefited from this intensive program that included math and computer classes guided by NY State Learning Standards, tours of SUNY Buffalo research labs, field trips to local technology industry, and faculty-guided STEM research for six BEAM Honors students.

Example of NYSG benefits to Outcome 3 (Informal Education):

With support from NYSG funding, the Astronomy & Astrophysics Department at Columbia University held twenty-eight outreach events in the NYC area so far, with eleven more planned for the first part of 2014. These events included a public lecture and stargazing series, film screenings followed by science fiction vs. fact discussions, guided observatory tours, and sidewalk astronomy sessions in Harlem. Columbia also collaborated with various organizations in NYC (e.g., Brooklyn Academy of Music and New York Early Music Celebration), complementing their cultural events with lectures or stargazing sessions, exposing a broad audience to the wonders of astronomy.

PROGRAM ACCOMPLISHMENTS

Outcome 1 [Fellowship/Scholarship, Higher Education, and Research Infrastructure programs] – In FY2013 NYSG provided many opportunities to develop the STEM workforce in disciplines needed to achieve NASA's strategic goals. Undergraduate and graduate students conducted research projects in a wide array of STEM fields (e.g., aeronautical, biomedical, electrical, and mechanical engineering; computer science and engineering; environmental engineering; atmospheric sciences; physics; astronomy and space sciences; human-machine interfaces/telerobotics; mechatronics/robotics; and applied mathematics) during the academic year and summer at **all** NYSG colleges/universities. Many students were involved in analyzing data from NASA science missions such as SOFIA, Solar Dynamics Observatory, Chandra X-Ray Observatory, Spitzer Space Telescope, and Fermi Gamma-ray Space Telescope. NYSG-supported students presented their research at various conferences, including the 2014 National Collegiate Research Conference at Harvard University, the 2013 Fall Meeting of the American Physical Society's Division of Nuclear Physics, and the 223rd Meeting of the American Astronomical Society. NYSG also supported student travel to conduct research (e.g., Kitt Peak National Observatory) and attend the CUNYSAT-1 launch.

Medgar Evers College (MEC) students and faculty advisors successfully prepared their first CubeSat, CUNYSAT-1, for launch. This project provided many underrepresented minority students with immense hands-on, interdisciplinary, and peer-mentoring experiences at MEC, an MSI located in Brooklyn. Years of hard work came to fruition as CUNYSAT-1 was deployed into space after a late-night launch on an Atlas 5 rocket at Vandenberg Air Force Base, California on December 5, 2013. Ten students were sponsored for summer 2013 NASA internships and NASA Academies at Ames Research Center, Glenn Research Center, Goddard Space Flight Center, Johnson Space Center, Langley Research Center, and Marshall Space Flight Center. Three undergraduate engineering students conducted NYSG co-funded internships at Lockheed Martin in Owego, NY and Syracuse, NY. Also during summer 2013 four engineering students participated in an internship program NYSG established with Moog Space and Defense in East Aurora, NY – two funded by NYSG and two by Moog. Finally NYSG sponsored an undergraduate student's participation in the 2013 Helicopter/UAV Program hosted by the Connecticut Space Grant Consortium, and two participants (a mechanical engineering

instructor and undergraduate student from Alfred University) in the 2013 RockOn Space Grant workshop at NASA Wallops Flight Facility.

Outcome 2 [Precollege] – NYSG funds supported the Buffalo Engineering Awareness for Minorities (BEAM) summer program, in which seventeen post-11th grade minority students took mini-courses in math, engineering, and computer science. BEAM students also visited many SUNY Buffalo research labs, and six of them conducted research projects with guidance from SUNY Buffalo engineering and computer science professors. NYSG also provided funds for precollege students to attend the Expanding Your Horizons Conference at Cornell (hands-on STEM activities and interactions with female scientists for 7th to 9th grade girls) and funds for economically challenged students from across NY State to attend the 4-H Career Explorations Conference (participants explored academic fields, developed leadership skills, and participated in hands-on workshops at Cornell). Four NYC high school students conducted mechatronics and robotics research projects, mentored by NYSG-supported college students, at the New York University (formerly NYU-Poly) Mechatronics Lab during summer 2013.

The 2013 CNY Rocket Team Challenge, run by the Museum of Science and Technology (MOST) and Syracuse University, included workshops for teachers and students and rocket science lectures. This program culminated in launch day on June 1, 2013 in which 109 rocket teams participated from 42 different schools. MOST and Syracuse also ran their annual Bridge Build'em and Bust'em event in November 2013, in which 266 teams of students built bridge structures that underwent stress testing by science/engineering professionals. Two hundred students from Central NY competed in the Regional VEX Robotics competition, held at MOST in January 2014.

Six teams of high school teachers and students from the NY Capital District and Long Island attended Union College's Physics Constants Workshop in December 2013, working on physics experiments utilizing instrumentation and techniques not available in high schools, such as particle accelerators and scanning electron microscopes. NYSG sponsored two teachers from the southern tier region of NY to participate in a five-day LEGO Engineering Institute at Tufts University (July 2013), a Space Grant Northeast Regional teacher workshop hosted by the Massachusetts Space Grant Consortium.

Outcome 3 [Informal Education] – Alfred University's Space Grant students conducted summer outreach events at Stull Observatory. Columbia University continued its very active astronomy outreach programs in the NYC area, including a widely attended public lecture and stargazing series, science fiction movie screenings accompanied by discussions of the science portrayed in the films, *Family Astro* events, school group visits, *Sidewalk Astronomy* program in Harlem, and complementing NYC-area cultural events with astronomy lectures and stargazing. More than 2,300 members of the public attended Columbia's twenty-eight outreach events thus far, with eleven more events already planned for the first part of 2014. The NYSG affiliate director at the New York University (formerly NYU-Poly) Mechatronics Lab and his students exhibited three projects at the NYU-Poly Inaugural Research Expo in May 2013: mobile apps for intuitive human-robot interaction, Caesar – an interactive robotic head that sees and hears

people, and a wearable interface to control a robotic manipulator. Their mechatronics exhibit was voted #1 of the 40 exhibits by attendees at the Expo. The Caesar project was also showcased at an NYU-Poly event as part of the World Science Festival in June 2013, attracting over 1,000 general public attendees. An NYSG-supported student developed a show about the nature of the planets in our solar system that will be used for astronomy classes and public outreach programs in Colgate University's Ho Tung Visualization Laboratory. The Sciencenter continued to raise awareness about NASA's missions and increase STEM literacy in surrounding rural areas by hosting community outreach events and participating in a FIRST LEGO Robotics Competition. The hands-on activities conducted earlier this budget year focused on earth and space sciences, including the use of a portable planetarium. Future activities planned for the remainder of fiscal year 2013 will focus on nanoscale science and engineering activities. More than 400 youth and their families participated in NYSG-supported Sciencenter programs so far, with an estimated 400 more participants in future events this fiscal year.

The New York Space Grant Consortium made the following progress towards meeting its SMART goals/objectives in FY2013:

1. The percentage of NYSG underrepresented minority student awardees (monetary and non-monetary) per budget year shall meet or exceed the underrepresented minority enrollment percentage in NY higher education institutions (30.7%, based on http://nces.ed.gov/programs/digest/d12/tables/dt12_265.asp). The percentage of underrepresented minority students participating in NYSG fellowship/scholarship, higher education, and research infrastructure programs from FY2013 funds was 32%.

2. The percentage of NYSG female student awardees (monetary and non-monetary) per budget year shall meet or exceed 38% (based on STEM bachelor's degrees awarded to females nationwide). The percentage of female students participating in NYSG fellowship/scholarship, higher education, and research infrastructure projects from FY2013 funds was 39%.

3. NYSG shall strive for 90% or more of graduating significant awardees to take the next step to STEM employment or advanced STEM degrees. A total of sixty-five students received significant awards during FY2013; fifty-two of these students have not yet graduated as of the data collection period (January 2014). Of the remaining thirteen students who graduated, ten are pursuing advanced STEM degrees, two are seeking STEM employment, and one is employed at an aerospace contractor (Moog, one of NYSG's industrial affiliates).

4. NYSG shall add 2-3 more industrial affiliates in New York State by the end of the 2010-2015 grant period. One new industrial affiliate (Moog) joined during the current grant period; NYSG is seeking at least one more industry partner within NY State.

5. Following their involvement in NYSG precollege programs, at least 75% of K-12 teachers participating in long-duration (≥2 days) training will utilize NASA

resources in their classroom instruction. Precollege teachers involved in the Central NY Rocket Team Challenge utilize the training and materials they receive to guide their students teams' rocket design, construction, launch, and analysis. Additionally, data from the Space Grant Northeast Regional teacher workshop can be used for this metric.

6. Following their involvement in NYSG precollege programs, at least 60% of K-12 teachers participating in short-duration training will utilize NASA resources in their classroom instruction. Teachers that participated in Union College's Physics Constants Workshop have passed along the excitement and new experiences/knowledge they gained to students in their classrooms.

7. Following their involvement in NYSG precollege programs, at least 50% of K-12 students will express interest in STEM careers. A majority of the students that participated in precollege programs (e.g., BEAM, Central NY Rocket Team Challenge, Bridge Build'em and Bust'em, VEX Robotics) have shown interest in STEM careers, as tracked by the BEAM program administrators and students' repeated participation in STEM competitions.

PROGRAM CONTRIBUTIONS TO NASA EDUCATION PERFORMANCE MEASURES

- **Student Data and Longitudinal Tracking:** Student participants so far in FY2013 = 75 (Fellowship/Scholarship = 37, Higher Education/Research Infrastructure = 38). Out of the total participants, 24 are underrepresented minorities (32%) and 29 are women (39%). Of the total participants so far, 65 students received significant awards; as of January 2014, 52 of these students are still enrolled in the same degree program, 10 graduated and are pursuing advanced STEM degrees, two are seeking STEM employment, and one is employed in STEM at an aerospace contractor.

- **Minority-Serving Institution Collaborations:** Three NYSG affiliates are minority-serving institutions: CUNY City College of New York, CUNY Medgar Evers College, and CUNY York College. The NYSG affiliate director at York College is now PI of a five-year NSF Partnerships in Astronomy & Astrophysics Research and Education (PAARE) grant to increase minority representation in those fields; the seeds of this project were sown in part with NY Space Grant support. While SUNY Stony Brook is not a minority institution, NYSG is partnered with its Louis Stokes Alliance for Minority Participation (LSAMP) program to provide underrepresented minorities with NASA-related research opportunities with Stony Brook faculty.

- **NASA Education Priorities:**
  - *Authentic, hands-on student experiences in science and engineering disciplines:* NY students benefited from STEM research and internship opportunities at **all** NYSG affiliate institutions, NASA centers, and two aerospace companies within NY State (Lockheed Martin, and Moog). Medgar

Evers College involved predominantly underrepresented minority students in its hands-on CubeSat project. CUNYSAT student team members applied theoretical concepts from computer, software, mechanical, and electrical engineering to real-world problem-solving and systems integration.

- *Diversity of institutions, faculty, and student participants (gender, underrepresented, underserved):* The NY Space Grant Consortium incorporates a wide variety of institutions (public and private, small and large higher education institutions; informal education organizations; and industry), spread throughout upstate NY and the New York City area, with faculty from many different STEM fields serving as affiliate directors. Of the college/university students that participated in NYSG FY2013 programs so far, 32% are underrepresented minorities and 39% are women.
- *Summer opportunities for secondary students on college campuses with the objective of increased enrollment in STEM disciplines or interest in STEM careers:* The Buffalo-area Engineering Awareness for Minorities (BEAM) program engaged post-11th grade minority students in faculty-mentored engineering and computer science projects at SUNY Buffalo. Four NYC high school students conducted mechatronics and robotics research projects, mentored by NYSG-supported college students, in the New York University (formerly NYU-Poly) Mechatronics Lab during summer 2013.
- *Community Colleges – develop new relationships as well as sustain and strengthen existing institutional relationships with community colleges.* Nearby CUNY community colleges have been involved with the CubeSat program led by Medgar Evers College.
- *Aeronautics research – research in traditional aeronautics disciplines, areas appropriate to NASA's unique capabilities, and needs of the Next Generation Air Transportation System (NextGen):* NYSG-sponsored summer 2013 interns engaged in diverse aeronautics research at NASA centers and Academies. For example, students analyzed various superalloys that NASA developed for use in turbine and compressor disks, conducted a feasibility study on an all-electric regional transport aircraft, compared experimental measurements of scramjet engine performance to computational fluid dynamic models, ran aerodynamics simulations of the D8 "Double Bubble" Aircraft, and designed and tested a continuous trailing edge control surface system.
- *Environmental Science and Global Climate Change – research and activities to better understand Earth's environments:* Four NYSG-sponsored Syracuse University interns conducted a variety of environmental engineering research on "Seasonal Variation of Atmospheric Deposition of Trace Metals in Urban Central NY," "Green Roof Efficiency Confirmation," "Monitoring Sedum Growth and Nutrient Retention in a Green Roof," and "Seasonal Variance in the Madison County Constructed Wetland." NYSG-supported interns in Union College's Ion-Beam Analysis Laboratory researched the effects of pollutants on rainwater and the atmosphere.

IMPROVEMENTS MADE IN THE PAST YEAR

During fiscal year 2013, the Sciencenter changed its volunteer recruiting and training methods to improve the experiences of both the audience and volunteers.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECT EXECUTION

1. **Alfred University**, Alfred, NY *[highly residential, Master's I, private]* undergraduate research and F/S, informal education
2. **Barnard College**, New York, NY *[highly residential, Baccalaureate - Liberal Arts, private]* **liberal arts college for women,** undergraduate research and F/S
3. **CUNY City College of NY**, New York, NY *[primarily nonresidential, Master's I, public]* **Minority Serving Institution,** graduate research and F/S
4. **CUNY Medgar Evers College**, Brooklyn, NY *[primarily nonresidential, Baccalaureate - General, public]* **Minority Serving Institution,** undergraduate research and F/S, student balloon (MECSAT) and CubeSat (CUNYSAT) programs
5. **CUNY York College**, Jamaica, NY *[primarily nonresidential, Baccalaureate - General, public]* **Minority Serving Institution,** undergrad and grad research and F/S
6. **Clarkson University**, Potsdam, NY *[highly residential, Doctoral/Research - Intensive, private]* undergraduate and graduate research and F/S
7. **Colgate University**, Hamilton, NY *[highly residential, Baccalaureate - Liberal Arts, private]* undergraduate research and F/S, informal education
8. **Columbia University**, New York, NY *[highly residential, Doctoral/Research - Extensive, private]* graduate research and F/S, precollege, informal education
9. **Cornell University**, Ithaca, NY *[primarily residential, Doctoral/Research - Extensive, private and public (land grant)]* **NYSG lead institution**, undergraduate and graduate research and F/S, other consortium-wide projects such as summer internship programs, precollege, and informal education
10. **Lockheed Martin**, Owego, NY – Aerospace industry affiliate providing student internships.
11. **Moog, Inc.**, East Aurora, NY – Aerospace industry affiliate providing student internships.
12. **New York University (formerly Polytechnic Institute of New York University, or NYU-Poly)**, Brooklyn, NY *[primarily nonresidential, Doctoral/Research - Intensive, private]* undergraduate and graduate research and F/S, precollege, informal education
13. **Rensselaer Polytechnic Institute**, Troy, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate and graduate research and F/S, precollege
14. **Rochester Institute of Technology**, Rochester, NY *[highly residential, Master's I, private]* graduate research and F/S
15. **Sciencenter**, Ithaca, NY – Non-profit informal education affiliate, precollege, informal education

16. **SUNY Binghamton**, Binghamton, NY *[highly residential, Doctoral/Research – Extensive, public]* undergraduate research and F/S
17. **SUNY Buffalo**, Buffalo, NY *[primarily residential, Doctoral/Research - Extensive, public]* undergraduate and graduate research and F/S, precollege
18. **SUNY Geneseo**, Geneseo, NY *[highly residential, Master's I, public]* undergraduate research and F/S
19. **SUNY Stony Brook**, Stony Brook, NY *[highly residential, Doctoral/Research - Extensive, public]* **NYSG is partnered with the LSAMP program which runs minority-focused projects,** undergraduate research and F/S
20. **Syracuse University**, Syracuse, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate research and F/S, precollege and informal education projects with the Museum of Science and Technology (MOST) in Syracuse
21. **Union College**, Schenectady, NY *[highly residential, Baccalaureate - Liberal Arts, private]* undergraduate research and F/S, precollege
22. **University of Rochester**, Rochester, NY *[highly residential, Doctoral/Research - Extensive, private]* undergraduate and graduate research and F/S

The National Space Grant Office requires two annual reports, the Annual Performance Data Report (APD) and the Office of Education Performance Measurement System (OEPM) report. The former is primarily narrative and the latter data intensive. Because the reporting timeline cycles are different, data in the two reports may not necessarily agree at the time of report submission. OEPM data are used for official reporting.